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(56) Documents Cited

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(58) Field of Search

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(54) Abstract Title

Keypad with multi-directional key of greater rigidity than the keypad membrane

(57) The keypad 20 includes a flexible silicon rubber membrane 23 provided as an integral piece with a polycarbonate plastic key 22, of greater rigidity than the membrane, inserted therein at the position of a multi-directional hollow rocker button 44. The combination of the flexible membrane and the rigid key improves the tactility of the keypad. The rigid nature of the multi-directional key and a central post 68 thereunder, prevents simultaneous actuation of multiple functions of the rocker button. In operation, the keypad may be placed over a panel switch or an electronic substrate (74, Fig. 4) of an electronic device, for example a telephone, such that electrically conductive tactile domes (78) on the substrate are depressed in response to downward pressure from the corresponding character button 34 to generate the appropriate signal. The keypad may also be used with any smart electronic device, including personal digital assistants (PDAs), pagers or facsimile machines.

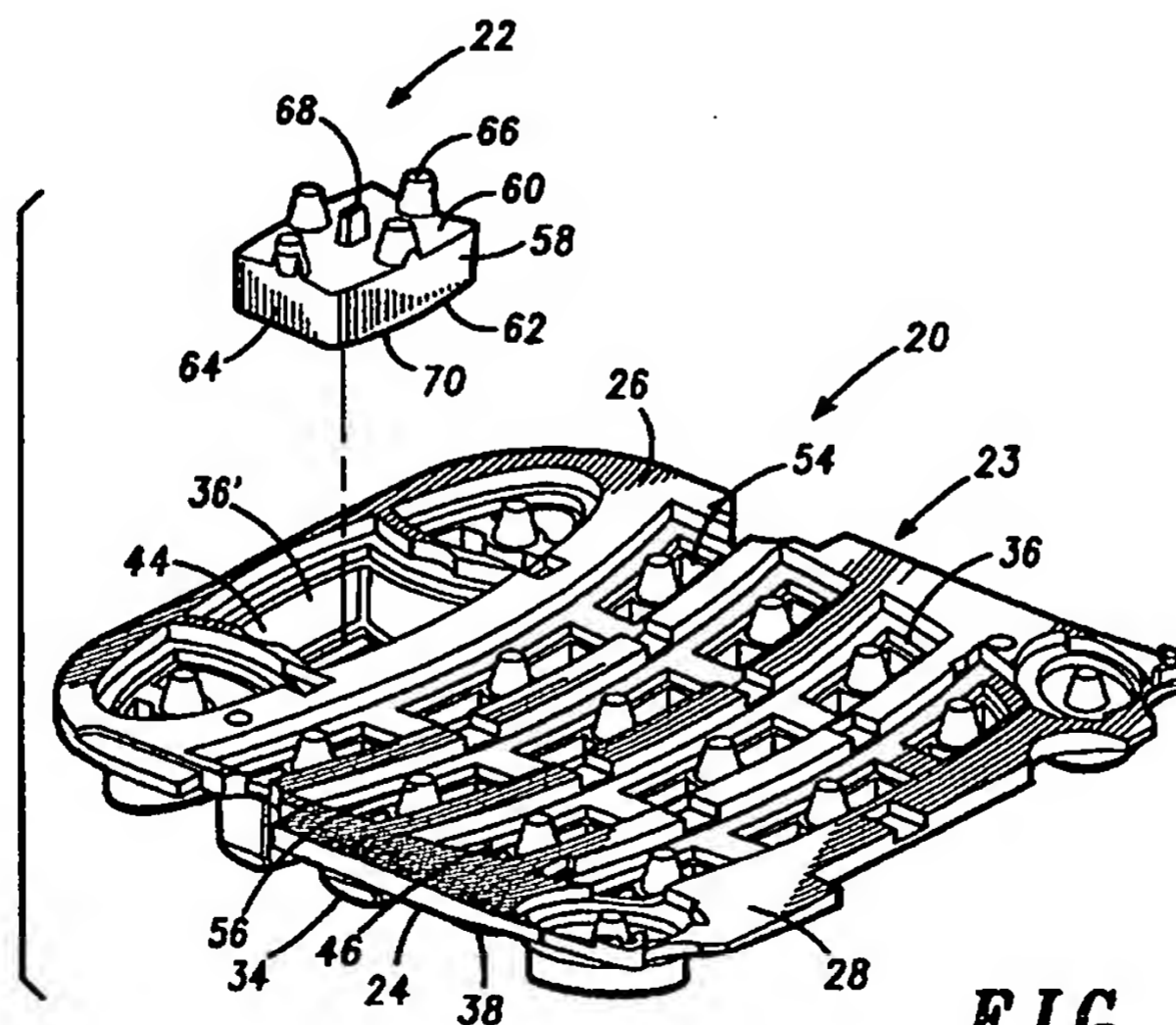


FIG. 2

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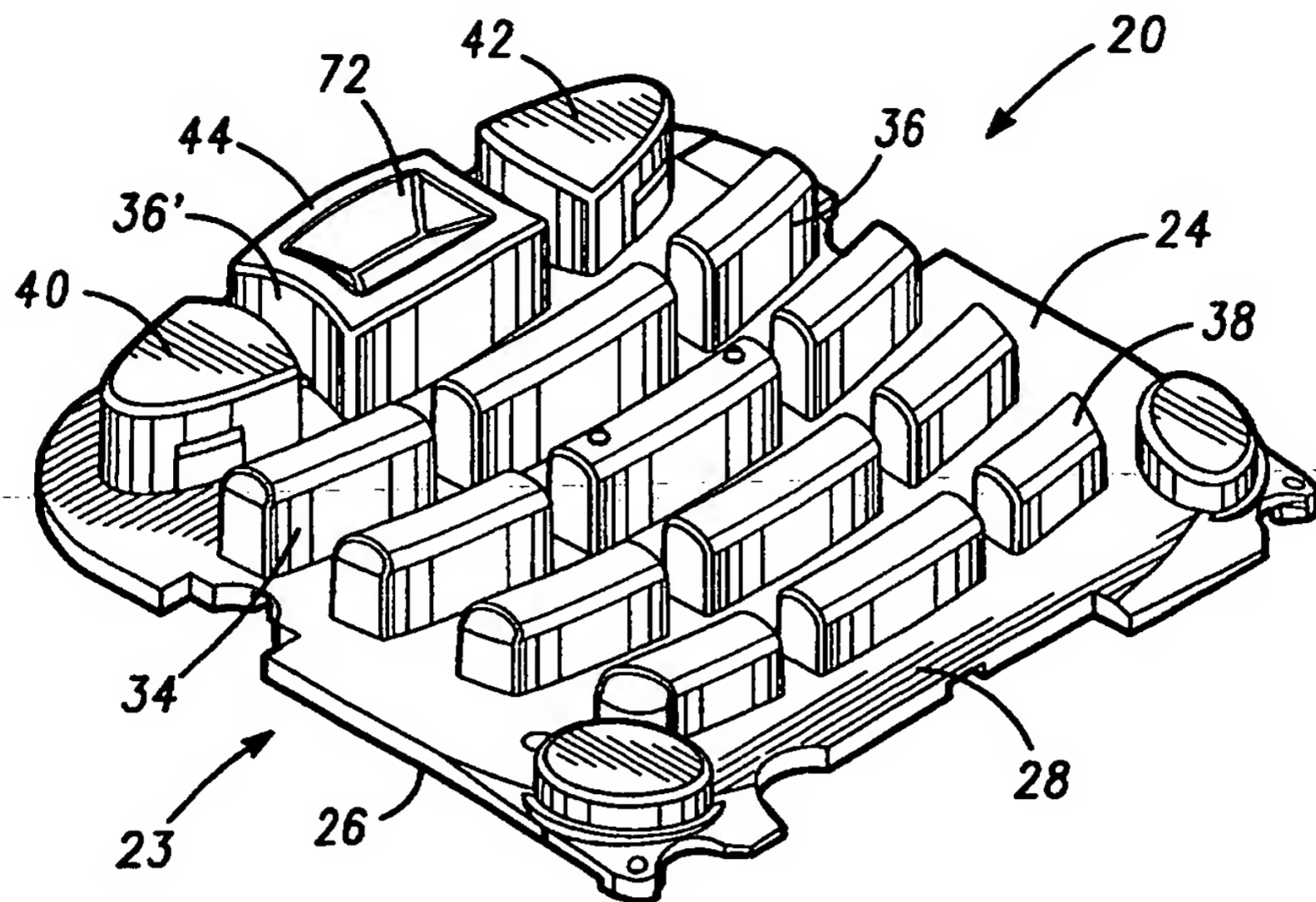


FIG. 1

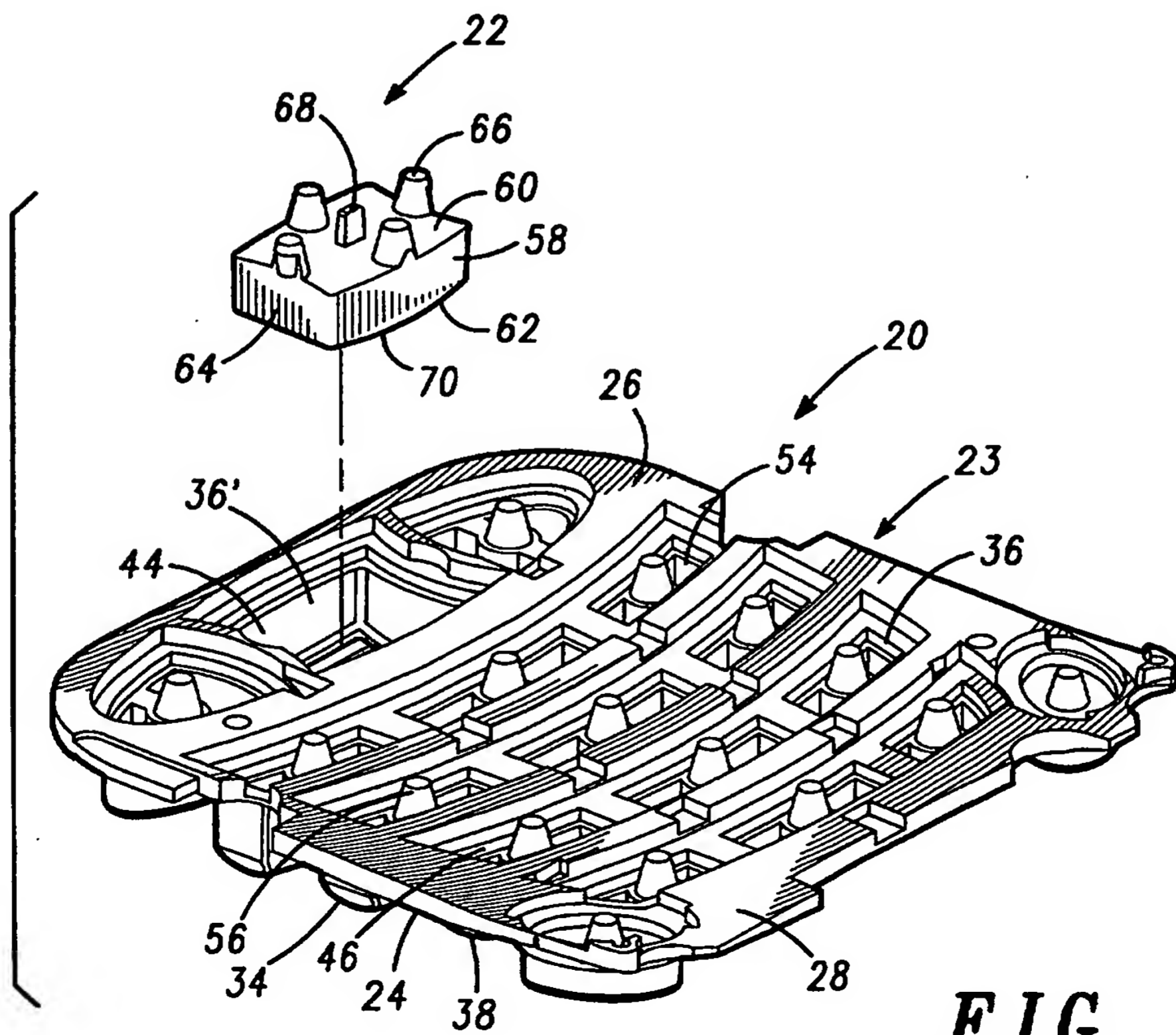


FIG. 2

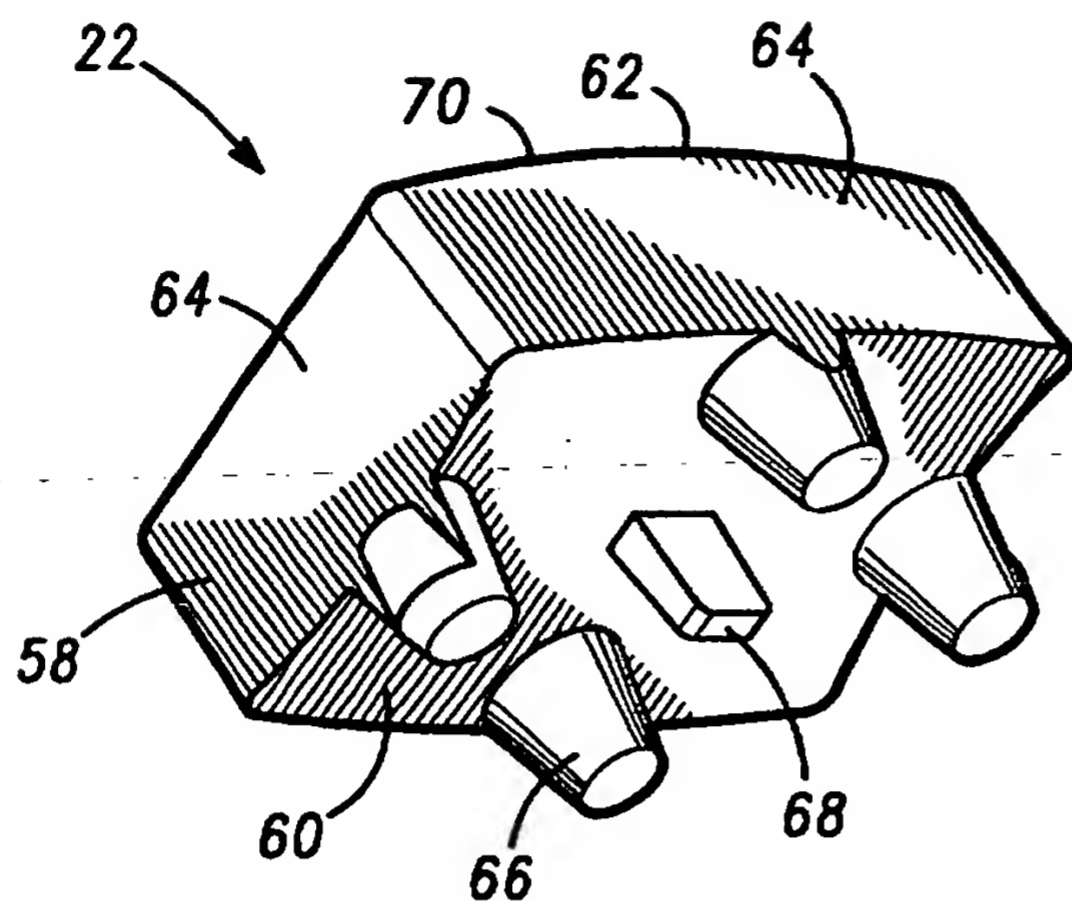


FIG. 3

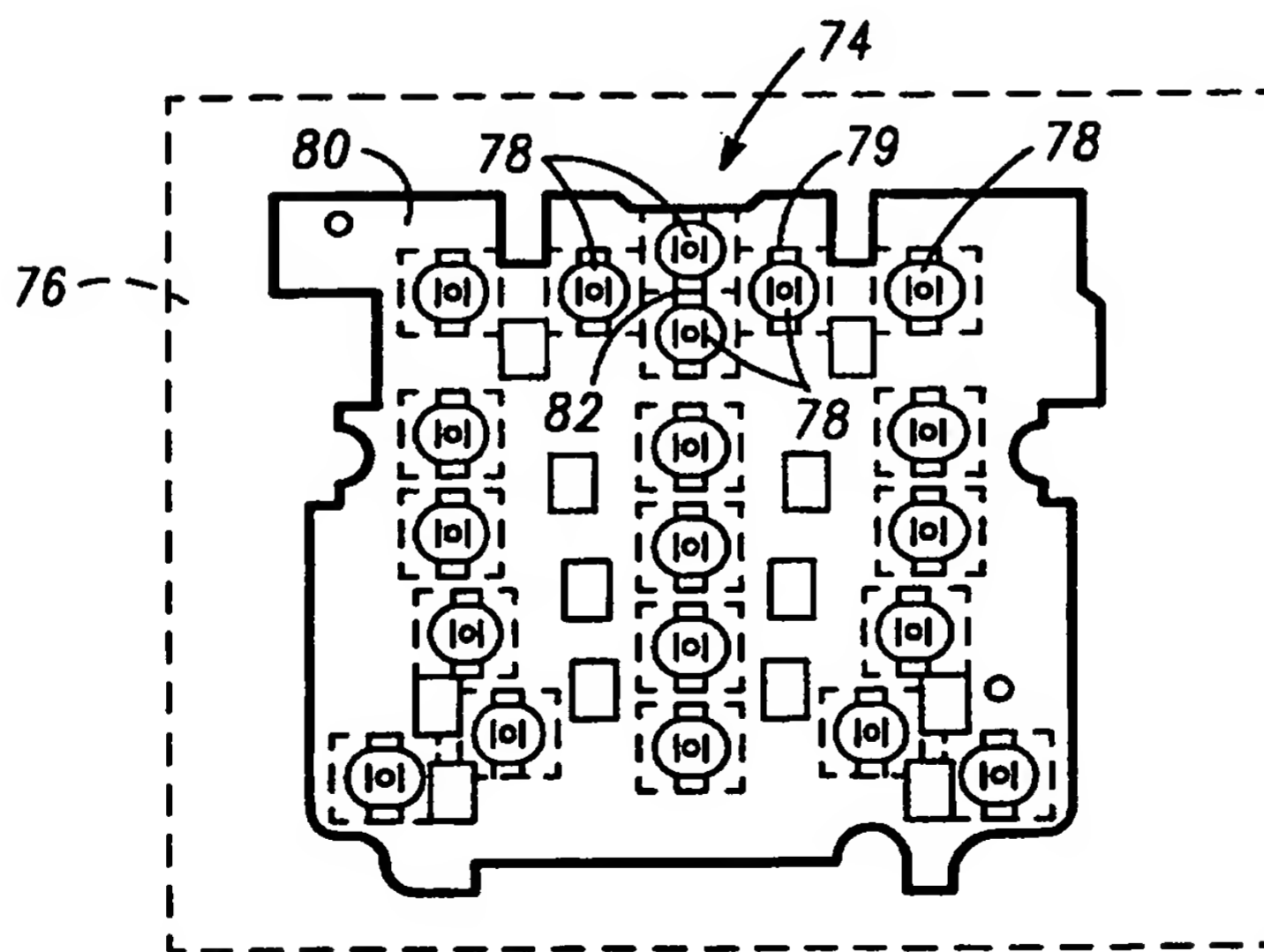


FIG. 4

KEYPAD WITH MULTI-DIRECTIONAL ROCKER BUTTON HAVING ENHANCED TACTILITY

Field of The Invention

The present invention generally relates to keypads for electronic devices and,
5 more particularly, relates to flexible keypads having multi-directional keys.

Background of The Invention

Keypads such as those used on telephones and other smart devices, such as
personal digital assistants, pagers, and calculators, often include a multi-directional
or multi-functional key used to move a screen cursor up, down, left, or right, or to
10 scroll through data displayed on the screen of the device. Such multi-directional keys
provide convenience to the user and minimize keypad space requirements.

Such keypads are often manufactured from a flexible material such as silicon
rubber. The flexible material is typically in the form of one, integrally molded piece
having a skirt with a plurality of buttons protruding therefrom. The outer surface of
15 the flexible material (the surface exposed to the user) typically includes printed,
laser-etched, or otherwise imprinted characters to facilitate ease of use by the
operator. With a typical telephone keypad, the buttons are typically labeled with the
well-known "0-9, *, #" block. The aforementioned multi-directional key might be
labeled accordingly with four arrowheads or the like.

20 The inner surface of the keypad may include a plurality of actuator tips, one
behind each button. Four such tips would be provided behind a typical four-direction,
multi-functional key. Each actuator tip is depressed when the respective button is
depressed, which in turn depresses a conductive (sometimes carbon) contact

against another metal contact to close a circuit, and thus generate a signal related to the function of the depressed button.

While the flexible silicon keypad provides durability and a desirable tactile feel for the user with single input keys, with a multi-directional key, the silicon rubber can suffer certain drawbacks. For example, the flexibility of the material itself may cause uncertainty to the user as to which direction is being depressed. Moreover, if sufficient force is imparted against the center of the multi-directional key, multiple actuator tips may be simultaneously depressed causing malfunction of the device to which the keypad is attached.

Certain keypads therefore provide a central post or other structure behind the center of a multi-directional key to avoid multiple actuation, but such structures are typically manufactured from the same flexible material, and thus are easily compressed. Sufficient force applied against the center of the multi-directional key can therefore, in such designs, result in multiple actuation as well.

Still other types of keypads provide a more rigid design such as with a thin metal stamping. Such increased rigidity, while providing increased certainty as to whether a button has been depressed, also lends itself toward fatigue, cracking, and a shorter serviceable life. Other types of keypads combine rigid and flexible materials, but result in an outer surface having lessened tactile feel, greater printing difficulty, and diminished aesthetic appeal.

Thus, there is a need for a keypad with enhanced tactility and durability, as well as less susceptibility to simultaneous actuation of multiple functions of a multi-functional key.

Brief Description of the Drawings

FIG. 1 is a top perspective view of a keypad embodying the present invention.

FIG. 2 is a bottom perspective view of the keypad shown in FIG. 1 with a multi-function key exploded away from the keypad.

5 FIG. 3 is an enlarged perspective view of the multi-function key shown top side up.

FIG. 4 is a top plan view of an electronics substrate and device to which the keypad may be attached.

While the invention is susceptible to various modifications and alternative
10 constructions, certain illustrative embodiments thereof have been shown in the drawings and will be described below in detail. It should be understood, however, that there is no intention to limit the invention to the specific forms disclosed, but on the contrary, the invention is to cover all modifications, alternative constructions and equivalents falling within the spirit and scope of the invention as defined by the
15 appended claims.

Detailed Description of the Preferred Embodiments

Referring now to the drawings, and with specific reference to FIG. 1, a preferred embodiment of the invention is depicted as a keypad 20. While the depicted keypad 20 is for use with a telephone, it is to be understood that the
20 present invention has applicability to any smart electronic device, including personal digital assistance (PDAs), pagers, facsimile machines, and the like.

The keypad 20 provides improved tactile feel over prior art designs, as well as less susceptibility to simultaneous actuation of multiple functions of a multi-function key. The keypad 20 is able to do so by, among other things, inserting a rigid rocker

key 22 into a flexible member 23, as shown best in FIG. 2 and as will be described in further detail below.

Turning now to FIGs. 1 and 2, flexible member 23 preferably includes an upper or cosmetic surface 24 and a lower or actuation surface 26. The flexible member 23 is preferably manufactured from silicon rubber through a press-molded operation such that surfaces 24 and 26 are provided on opposite sides of one integral piece. In alternative embodiments, surfaces 24 and 26 may be molded as separate layers and assembled together, or may be manufactured from a different material or manufacturing technique. However, flexible materials are preferably employed to provide desirable tactility and durability.

The cosmetic surface 24 includes a substantially planar face or skirt 28 from which a plurality of buttons 34 extend. Each button 34 includes a shell 36 and a top 38 adapted to be printed, laser-etched, or otherwise imprinted with characters for guidance of the user. Each shell 36 is preferably hollow, but may be provided in solid form. The depicted embodiment shows a sufficient number of buttons 34 to accommodate characters in the common configuration of 0 through 9, *, and #, as well as "send" and "end" buttons 40 and 42, and a multi-directional or rocker button 44. The rocker button 44 may, among other things, allow a cursor provided on a screen (not shown) to be moved left, right, up, or down, allow displayed material to be quickly scanned through, while occupying relatively little space on the keypad 20, an important consideration with any portable electronic device, and facilitate use with electronic games and the like.

As shown best in FIG. 2, the actuation surface 26 is provided on the side of the flexible member 23 opposite the cosmetic surface 24. The actuation surface 26 includes the opposite side of the substantially planar skirt 28 and a plurality of

apertures 46 leading to the plurality of shells 36 of the cosmetic surface 24.

Downwardly extending from an interior ledge 54 of each shell 36 is an actuator tip 56. In the preferred embodiment, the actuator tips are frusto-conical in shape, but other forms and shapes are certainly possible.

5 It will be noted that the actuator tips 56 extend from each shell 36, except for the shell 36' of the rocker button 44. Rather, as shown in FIG. 2, the rigid key 22 is inserted into the hollow shell 36' of the rocker button 44. The rigid key 22 is shown in detail in FIG. 3. As depicted, the rigid key 22 includes a trapezoidal prism-shaped base 58 having a bottom 60, a top 62 and four sides 64. It is to be understood that a
10 variety of other shapes including parallelepipeds, cylinders, frusto-cones, hemispheres, and the like can be employed. Extending from the bottom 60 are a plurality of tips 66, similar in size and shape to the actuation tips 56. In the depicted embodiment, four such tips 66 are provided, with one being provided proximate each side 64. Positioned centrally on the bottom 60 is a central post 68, which is taller
15 than the tips 66, the importance and function of which will be discussed in further detail herein. The top 62 includes arcuate surfaces 70 proximate each side 64 and a divot 72 provided centrally within the top 62. Alternately, the top 62 may have a flat surface or bump instead of a divot 72.

 As opposed to the cosmetic surface 24 and actuation surface 26 which are
20 preferably manufactured from a flexible material, the rigid key 22 is preferably manufactured from a rigid material, with the preferred embodiment being manufactured from polycarbonate plastic. Other materials including acrylics and resins are possible. It is the rigidity of key 22 in combination with the flexibility of the flexible member 23 which provides for improved tactile feel in the keypad 20.

Turning to FIG. 4, the keypad 20 is adapted to be positioned over a panel switch or an electronic substrate 74 of an electronic device 76, such as a telephone. The electronic substrate 74 includes a plurality of tactile domes 78 manufactured from electrically conductive material such as gold. The tactile domes 78 are provided on a planar sheet 80 typically manufactured from plastic. Below each tactile dome 78 is a second electrically conductive contact (not shown). Therefore, when a particular tactile dome 78 is downwardly pressed, that tactile dome 78 engages the corresponding second contact, closing a circuit, and generating a signal corresponding to the character button 34 being depressed. More specifically, the user depresses a button 34 (shown in FIG. 2), which in turn depresses an actuator tip 56 (shown in FIG. 2), which in turn depresses a tactile dome 78 (shown in FIG. 3).

It will be noted from FIG. 4 that in a position immediately below the rocker button 44, four tactile domes 78 are provided in a diamond configuration 79. These four tactile domes 78 represent an "up" tactile dome, a "down" tactile dome, a "right" tactile dome, and a "left" tactile dome. A non-conductive area 82 is provided in the center of the four tactile domes 78 in the diamond-shaped configuration 79. The central post 68 of the rigid key 22 is a pivot against the non-conductive area 82 when the rocker button 44 is depressed. Therefore, if force is exerted against the rocker button 44 in a general direction, i.e., not against any one of the four sides 64 of the rigid key 22, the central post 68 engages the non-conductive area 82, and no directional signal is generated by the four tactile domes 78. This provides greater reliability than the prior art, which includes flexible actuation tips for such a multi-directional key as well as flexible structures at the center of the multi-function key. The flexible structures at the center of the multi-function key tend to depress and

allow for multiple directional actuation even when only generally directed force is imparted against the multi-function key:

5 The rigid key 22 is preferably installed into an underside of the flexible member 23 to provide a continuous silicon rubber surface and desirable tactile feel for the cosmetic surface 24, while at the same time providing a more easily printable surface for characters thereon. Although the preferred embodiment creates a pivot by having the central post 68 be longer than the tips 66, alternative pivots can be constructed by shortening or eliminating the central post 68 and heightening the non-conductive area 82.

10 From the foregoing, it can therefore be seen that the present invention provides an improved keypad with enhanced tactility, and less susceptibility to simultaneous actuation of multiple functions of a multi-function key. Many additional changes and modifications could be made to the invention without departing from the fair scope and spirit thereof. The scope of some changes is discussed above. The
15 scope of others will become apparent from the appended claims.

 We claim:

CLAIMS

1 1. A telephone, having a keypad comprising:
2 a flexible member having a cosmetic surface and an actuation surface, the
3 cosmetic surface having a plurality of depressable buttons, the actuation surface
4 being positioned opposite the cosmetic surface and having a plurality of forms
5 corresponding in number and position to plurality of depressable buttons, the
6 actuation surface being adapted to be positioned over a plurality of tactile domes
7 corresponding in number and position to the plurality of depressable buttons and the
8 plurality of forms, a tactile dome being actuated upon depression of a corresponding
9 depressable button and a corresponding form; and
10 a multi-directional key inserted into the flexible member and being adapted to
11 be positioned over multiple tactile domes, the multi-directional key having greater
12 rigidity than the flexible member.

1 2. The telephone of claim 1 wherein the multi-directional key is adapted to
2 positioned over an "up" tactile dome and a "down" tactile dome, and wherein the
3 multi-directional key further includes a central post to inhibit actuation of more than
4 one of the "up" tactile dome and the "down" tactile dome.

1 3. The telephone of claim 2 wherein the multi-directional key is adapted to
2 positioned over an "right" tactile dome and a "left" tactile dome, and wherein the
3 central post inhibits actuation of more than one of the "up" tactile dome, the "down"
4 tactile dome, the "right" tactile dome, and the "left" tactile dome.

1 4. The telephone of claim 1 wherein the flexible member is manufactured
2 from silicon rubber and the multi-directional key is manufactured from polycarbonate
3 plastic.

1 5. The telephone of claim 4 wherein the flexible member is formed from a
2 single, molded piece of material and the multi-directional key is press fit into an
3 underside of the flexible member.

1 6. The telephone of claim 1 wherein the cosmetic surface is labeled with
2 symbols to provide guidance to a user of the telephone.

1 7. The telephone of claim 1 wherein the multi-directional key comprises:
2 a base having a bottom surface;
3 four forms extending from the bottom surface of the base; and
4 a post extending parallel to at least one of the four forms and positioned
5 centrally on the bottom surface of the base.

1 8. The telephone of claim 7 wherein a top surface of the multi-directional
2 key includes a central divot.

1 9. A keypad, comprising:
2 a flexible member having at least one hollow button depressable in multiple
3 directions extending therefrom; and
4 a rigid key inserted into the at least one hollow button.

- 1 10. The keypad of claim 9 wherein a bottom surface of the rigid key
2 includes a plurality of actuation tips and a central pivot, the central pivot inhibiting
3 simultaneous depression of more than one of the plurality of actuation tips.



Application No: GB 0021669.7
Claims searched: 1-10

Examiner: Gary Williams
Date of search: 30 November 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl.(Ed.R): B6F:FCGK; H1N:NUJD
Int Cl (Ed.7): B41J: 5/28; G06F: 3/023; H01H: 25/04; H04M: 1/02,1/23
Other: Online:EPODOC,PAJ,WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP 1037230 A2 (MATSUSHITA) See Fig.7, col.7 line 52 - col.8 line 41	1
A	WO 99/22391 A1 (BOSCH) 06.05.99 (See Figs.1-3, page 2 line 26 - page 4 line 8, and also WPI Abstract Accession No. 99-303105/25).	1
X	DE 19636183 A1 (KOSTAL) 12.03.98 (see Figs.1-5, and also WPI Abstract Accession No. 98-169851/16).	9
A	US 5564560 (GARMIN) See Figs.6-8, col.5 line 52 - col.6 line 42	1
X	US 5012230 (SONY) See Fig.2, col.4 line 45 - col.5 line 66	9
X	US 4861950 (ALPS) See Figs.3-7, col.4 line 43 - col.6 line 26	9
X	US 4590338 (KK TOKAI) See Figs.1&2, col.3 line 26 - col.4 line 58	9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.